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COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2013

Serial No. ____

ELECTRICAL ENGINEERING

Code No. 08

A

Time Allowed : Two Hours | ***Maximum Marks : 300***

INSTRUCTIONS

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9. While writing Centre, Subject and Roll No. on the top of the Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN".**
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ROUGH WORK

1. Ohm's law is applicable to :
   (A) Semi-conductors
   (B) Vacuum tubes
   (C) Electrolytes
   (D) Semiconductors and Vacuum tubes

2. The resistance between the opposite faces of 1m. cube is found to be 1Ω . If its length is increased to 2 m, with its volume remaining the same, then its resistance between the opposite faces along its length is :
   (A) 2 Ω
   (B) 4 Ω
   (C) 1 Ω
   (D) 8 Ω

3. Three resistances of 3 Ω each are connected in delta. The value of the resistances in the equivalent star is :
   (A) 27
   (B) 9
   (C) 1.5
   (D) 1 Ω

4. Thevenin's theorem can be applied to network containing :
   (A) Passive elements only
   (B) Active elements only
   (C) Linear elements only
   (D) All of these

5. Which of the following is the unit of time constant of an RC network ?
   (A) Second
   (B) $\frac{R \times \text{ampere} \times \text{second}}{V}$
   (C) $\frac{R \times \int idt}{V}$
   (D) All of these

6. A floating battery is one :
   (A) in which battery voltage is equal to charger voltage
   (B) in which the current in the circuit is fully supplied by battery
   (C) which gets charged and discharged simultaneously
   (D) which supplies current intermittently and also during off cycle gets charged

7. Which of the following statements is not correct ?
   (A) A primary cell is an electro-chemical cell
   (B) After charging, a primary cell can be again put to use
   (C) Dry cell is a primary cell
   (D) Leclanche cell is used in experiments, where constant supply of current is not needed

8. The efficiency of a solar cell can be expected in the range :
   (A) 10 to 15 percent
   (B) 25 to 30 percent
   (C) 45 to 60 percent
   (D) 70 to 80 percent

9. A 10 kW electric motor drives a vehicle at an average speed of 50 Km/h. Ten, 12 V, 100A-h batteries supply the motor, the maximum distance that the vehicle may travel before the batteries must be recharged, will be :

(A) 30 Km (B) 45 Km
(C) 60 Km (D) 80 Km

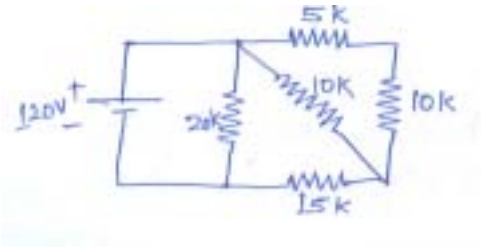
10. A power factor of incandescent bulb is :

(A) 0.8 lagging (B) 0.8 leading
(C) Unity (D) Zero

11. A high pass filter has a resistance R = 2 kΩ. The lowest input frequency to be passed is 7.5 KHz. The value of suitable coupling capacitor must be :

(A) 0.1 pF (B) 1 pF
(C) 0.1 μ F (D) 1 μ F

12. In the network shown the value of the current supplied by the battery will be :



(A) 1.17 A (B) 11.7 A
(C) 11.7 mA (D) 117 mA

13. In a Circuit, a resistance R, a pure inductance L, and a Capacitance C are connected in parallel across a sinusoidal voltage source of V volt. The circuit current will lead the applied voltage if :

(A) $I_c < I_L$ (B) $I_c = I_L$
(C) $I_c > I_L$ (D) None of these

14. For $V(s) = \frac{s+2}{s(s+1)}$, the initial and final values of V(t) will be respectively :

(A) 1 and 1 (B) 2 and 2
(C) 2 and 1 (D) 1 and 2

15. Inverse Laplace transform of $\frac{10}{s(s+1)}$ is :

(A) $10\,[1 + e^{-t}]$ (B) $10\,[1 + e^{t}]$
(C) $10\,[1 - e^{-t}]$ (D) $10\,[1 - e^{t}]$

16. Impulse response of an R–L circuit is a :
(A) Rising exponential function
(B) Decaying exponential function
(C) Step function
(D) Parabolic function

17. For a two port network to be reciprocal :
(A) $Z_{11} = Z_{22}$
(B) $Y_{21} = Y_{12}$
(C) $h_{21} = -h_{12}$
(D) $AD - BC = O$

18. In a network containing resistances and reactances the roots of the characteristic equation give for the circuit :
(A) The forced response
(B) The total response
(C) The natural response
(D) The damped response

19. Which of the following is an example of an open loop system ?
(A) Household refrigerator
(B) Respiratory system of an animal
(C) Stabilisation of air pressure entering into a mask
(D) Execution of a program by a computer

20. The transfer function of a first order control system is of the type :
(A) $\frac{1}{Ts^2 + 1}$
(B) $\frac{1}{Ts + 1}$
(C) Ts
(D) $\frac{1}{Ts}$

21. The response c(t) of a system to an input r(t) is given by the following differential equation

$$\frac{d^2c(t)}{dt^2} + 3\frac{dc(t)}{dt} + 5c(t) = 5r(t)$$

The transfer function of the system is given by :
(A) $G(s) = \frac{5}{s^2 + 3s + 5}$
(B) $G(s) = \frac{1}{s^2 + 3s + 5}$
(C) $G(s) = \frac{3s}{s^2 + 3s + 5}$
(D) $G(s) = \frac{s + 3}{s^2 + 3s + 5}$

22. With the feedback system, the transient response :
(A) Decays slowly
(B) Decays rapidly
(C) Rises slowly
(D) Rises quickly

23. A phase-lag compensation will :
(A) Improve relative stability
(B) Increase the speed of response
(C) Increase bandwidth
(D) Increase overshoot

24. In a stable control system saturation may cause :
(A) Conditional Stability
(B) High Level Oscillations
(C) Overdamping
(D) Low Level Oscillations

25. Given, $G(s) = \frac{1}{s(1 + 6s)}$, the system stability is :
(A) Conditional
(B) Absolute
(C) Marginal
(D) Limited

26. The number of roots in the right half of s-plane for the equation $s^3 - 4s^2 + s + 6 = 0$ would be :
(A) 1
(B) 2
(C) 3
(D) 4

27. If the Nyquist plot cuts the negative real axis at a distance of 0.4, then the gain margin of the system is :
(A) 0.4
(B) -0.4
(C) 4%
(D) 2.5

28. Which input yields natural response ?
(A) Step input
(B) Sinusoidal input
(C) Impulse input
(D) Ramp input

29. Sinusoidal oscillators are :
(A) Stable
(B) Unstable
(C) Marginally stable
(D) Conditionally stable

30. If the system specifications are given in time domain, best approach for designing is :
(A) Nyquist Plot
(B) Bode's Plot
(C) Root Locus
(D) None of these

31. The velocity of a travelling electromagnetic wave in free space is given by :
(A) $\mu_0 \in_0$
(B) $\sqrt{\mu_0 \in_0}$
(C) $\frac{1}{\sqrt{\mu_0 \in_0}}$
(D) $\frac{1}{\mu_0 \in_0}$

32. Maxwell's divergence equation for the magnetic field is given by :

(A) (B)

(C) (D) $\nabla \cdot B = \rho$

33. The electric field lines and equipotential lines :

(A) are parallel to each other (B) are one and the same

(C) cut each other orthogonally (D) can be inclined to each other at any angle

34. The noise temperature of sky is about :

(A) 100° K (B) 273° K

(C) 0° K (D) 30° K

35. The value of $\oint d\,l$ along a circle of radius 2 units is :

(A) Zero (B) $2\,\pi$

(C) $4\,\pi$ (D) $8\,\pi$

36. The unit of $\mu_0 \in_0$ is :

(A) Farad Henry (B) $Sec^2/meter^2$

(C) amp sec/volt sec. (D) newton $meter^2/Coulomb^2$

37. Which one of the statements does not pertain to the equation $\nabla \cdot B = 0$:

(A) There are no sinks and sources for magnetic fields

(B) Magnetic field is perpendicular to the electric field

(C) Single magnetic pole cannot exist

(D) B is solenoidal

38. An air filled rectangular waveguide has dimensions 6 cm, 4 cm. The cut off frequency for TE_{10} is :

(A) 2.5 GHz (B) 25 GHz

(C) 25 MHz (D) 5 GHz

39. The intrinsic impedance of a lossy dielectric medium is given by :

(A) (B) $\int \omega\, \varepsilon / \mu$

(C) $\sqrt{\int \omega\, \mu / (\sigma + j\, \omega\, \varepsilon)}$ (D) $\sqrt{\mu / \varepsilon}$

40. The equation $V \cdot j = 0$ is known as :

(A) Poissons's equation (B) Laplace equation

(C) Continuity equation (D) Maxwell equation

41. Which of the following relations is correct :

(A) (B)

(C) (D) All of the above

42. If V, w, q stand for voltage, energy and charge then V can be expressed as :

(A) (B) $V = \frac{dw}{dq}$

(C) $dV = \frac{dw}{dq}$ (D) $dV = \frac{dq}{dw}$

43. A null type of instrument as compared to a deflection type instrument has :

(A) a higher accuracy (B) a lower sensitivity

(C) a faster response (D) all of the above

44. The usage of electronic instruments is becoming more extensive because they have :

(A) a high sensitivity and reliability

(B) a fast response and compatibility with digital computers

(C) the capability to respond to signals from remote places

(D) all of the above

45. The input resistance of a Cathode ray Oscilloscope is of the order of :

(A) tens of ohm (B) mega ohm

(C) kilo ohm (D) fraction of an ohm

46. An 0-10 A ammeter has a guaranteed accuracy of 1% of full scale deflection. The limiting error while reading 2.5 A is :

(A) 1% (B) 2%

(C) 4% (D) None of the above

47. A set of readings has a wide range and therefore it has :

(A) Low precision (B) High precison

(C) Low accuracy (D) High accuracy

48. The voltage of a circuit is measured by a voltmeter having an input impedance comparable with the output impedance of the circuit thereby causing error in voltage measurement. This error may be called :

(A) Gross error (B) Random error

(C) Error caused by misuse of instrument (D) Error caused by loading effect

49. The most stable primary atomic standard for frequency is :
(A) Caesium beam standard
(B) Hydrogen maser standard
(C) Quartz standard
(D) Rubidium vapour standard

50. The material of wires used for making resistance standards is usually :
(A) Manganin
(B) Nichrome
(C) Copper
(D) Phosphor Bronze

51. In a flux meter :
(A) the controlling torque is produced by weights attached to moving coil
(B) the controlling torque is produced by springs
(C) there is no controlling torque
(D) none of the above

52. The relative damping in a galvanometer is 0.8. Its logarithmic decrement is approximately :
(A) 0.48
(B) 1.25
(C) 4.19
(D) –4.19

53. The power consumption in PMMC instruments is typically about :
(A) 0.25 W to 2W
(B) 0.25 mW to 2 mW
(C) 25 μW to 200 W
(D) None of the above

μ 54. A meggar is used for measurement of :
(A) low valued resistances
(B) medium valued resistances
(C) high valued resistances, particularly insulation resistance
(D) all of the above

55. The moving iron voltmeters indicate :
(A) the same value for d.c. and a.c. voltages
(B) lower values for a.c. voltages than for corresponding d.c. voltages
(C) higher values for a.c. voltages than for corresponding d.c. voltages
(D) none of the above

56. Electronic Voltmeters which use rectifiers employ negative feedback, this is done :
(A) to increase the overall gain
(B) to improve stability
(C) to overcome non-linearity of diodes
(D) none of the above

57. A true rms reading Voltmeter uses two thermocouples in order :
(A) to increase sensitivity
(B) that the second thermocouple cancels out the non-linear effects of the first thermocouple
(C) to prevent drift in the d.c. amplifier
(D) all of the above

58. In an electronic ohm meter, an OP-Amp is used as :
(A) Summer
(B) Multiplier
(C) Buffer amplifier
(D) Integrator

59. A vertical amplifier for a CRO can be designed for :
(A) Only a high gain
(B) Only a broad bandwidth
(C) A constant gain times bandwidth product
(D) All of the above

60. In CRT the focusing anode is located :
(A) between pre-accelerating and accelerating anodes
(B) after accelerating anode
(C) before pre-accelerating anode
(D) none of the above

61. In a communications system, noise is most likely to affect the signal :
(A) at the transmitter
(B) in the channel
(C) in the information source
(D) at the destination

62. Which of the following statements is true :
(A) Random noise power is inversely proportional to bandwidth
(B) Flicker is sometimes called demodulation noise
(C) Noise in mixers is caused by inadequate image frequency rejection
(D) A random voltage across a resistance cannot be calculated

63. In a low-level AM system, amplifiers following the modulated stage must be :
(A) linear devices
(B) harmonic devices
(C) class C amplifiers
(D) non-linear devices

64. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4; the total modulation index :
(A) is 1
(B) cannot be calculated unless the phase relations are known
(C) is 0.5
(D) is 0.7

65. To provide two or more voice circuits with the same carrier, it is necessary to use :
(A) ISB
(B) Carrier reinsertion
(C) SSB with pilot carrier
(D) Lincompex

66. One of the following cannot be used to remove the unwanted sideband in SSB, this is the :
(A) Filter system
(B) Phase-shift method
(C) Third method
(D) Balanced modulator

67. Indicate which one of the following is not an advantage of FM over AM :
(A) Better noise immunity is obtained
(B) Lower bandwidth is required
(C) The transmitted power is more useful
(D) Less modulating power is required

68. To prevent overloading of the last IF amplifier in a receiver, one should use :
(A) Squelch
(B) Variable sensitivity
(C) Variable selectivity
(D) Double Conversion

69. To couple a coaxial line to a parallel-wire line, it is best to use a :
(A) Slotted line
(B) Balun
(C) Directional coupler
(D) Quarter-wave transformer

70. High frequency waves are :
(A) absorbed by the F_2 layer
(B) reflected by the D-layer
(C) capable of use for long distance communications on the moon
(D) affected by the solar cycle

71. After a target has been acquired, the best scanning system for tracking is :
(A) Nodding
(B) Spiral
(C) Conical
(D) Helical

72. Semiconductors have electrical conductivity of the order of :
(A) 10^{-15} S/m
(B) 10^{-10} S/m
(C) 1.0 S/m
(D) 10^{5} S/m

73. In an ac amplifier, smaller the internal resistance of the ac signal source :
(A) Larger the current gain
(B) Smaller the circuit voltage gain
(C) Larger the circuit voltage gain
(D) (A) and (B) both

74. In an amplifier, the coupling capacitors are employed for :
(A) limiting the bandwidth
(B) matching the impedances
(C) controlling the output
(D) preventing of dc mixing with input or output

75. A diac is equivalent to :
(A) Pair of Diodes
(B) Triac with two gates
(C) Pair of four-layer SCRs
(D) Diode with two transistors

76. Silicon steel is used for transformer core because :
(A) it reduces hysteresis loss
(B) it reduces eddy current loss
(C) it increases core permeability
(D) all of the above

77. The core in a large power transformer is built of :
(A) Cast iron
(B) Mild steel
(C) Ferrite
(D) Silicon steel

78. A 400/200 V transformer has a pu impedance of 0.05. The HV side voltage required to circulate full load current during short circuit test is :
(A) 40 V
(B) 20 V
(C) 10 V
(D) 5 V

79. Phase relationship between mmf phasor and emf phasor in a synchronous machine is :
(A) leads by 90°
(B) lags by 90°
(C) and are in phase
(D) This angle depends upon the pf of the load

80. Why is it necessary to provide compensating winding in a DC motor ?
(A) To help achieve good commutation
(B) To prevent a large speed drop
(C) To prevent commutator flash over upon sudden change in load
(D) To reduce the main field ampere-turns

81. A synchronous motor with 5 Ω synchronous reactance draws a leading current of 10 A at 400 V. The induced emf is :
(A)
(B) $400 - j\sqrt{3}\times 50$
(C) $400 - \sqrt{3}\times 50$
(D) $400 + \sqrt{3}\times 50$

82. Which of the following statements is correct ?
(A) X_d and X_q are different in a round rotor machine at lagging pf only
(B) X_d and X_q are different in a round rotor machine at any pf
(C) X_d and X_q are different in a salient pole machine at lagging pf only
(D) X_d and X_q are different in a salient pole machine at any pf

83. If stator impedance is neglected, the maximum torque in an induction motor occurs at a rotor resistance of :
(A) $(1 + s)\, x_2$ (B) $(1 - s)\, x_2$
(C) sx_2 (D) x_2

84. At low slip the torque slip characteristic is :
(A) $T \alpha \frac{1}{s^2}$ (B) $T \alpha S^2$
(C) $T \alpha 1/s$ (D) $T \alpha s$

85. A full-pitched coil in a 6-pole machine has a mechanical angle span of :
(A) 30° (B) 60°
(C) 90° (D) 180°

86. A 230 V dc series motor is connected to 230 V ac, it will :
(A) run slowly (B) not run at all
(C) run with less efficiency (D) none of these

87. In a 25-KVA 3300/230 V, single phase transformer the iron and full load copper losses are 350 W and 400 W respectively. The load at which the efficiency will be maximum is :
(A) 25 KW (B) 21.875 KW
(C) 25 KVA (D) 21.875 KVA

88. A 3-ϕ, 6 pole induction motor operates on 440 V, 50Cls supply. If the actual speed of the motor is 960 rpm, the slip will be :
(A) 6% (B) 5%
(C) 4% (D) 0.4%

89. When an induction motor runs at rated load and speed, the iron losses are :
(A) negligible (B) very heavy
(C) independent of supply frequency (D) independent of supply voltage

90. Which of the following transformers is smallest ?
(A) 1 KVA, 50Hz
(B) 1 KVA, 200Hz
(C) 1 KVA, 400Hz
(D) 1 KVA, 600Hz

91. Two mechanically coupled alternators deliver power at 50 Hz and 60 Hz respectively. The highest speed of the alternator is :
(A) 3600 rpm
(B) 3000 rpm
(C) 600 rpm
(D) 500 rpm

92. Synchronous speed is defined as the speed at which the :
(A) stator magnetic field rotates
(B) rotor rotates on no load
(C) rotor rotates on full load
(D) none of the above

93. The losses that occur in an induction motor are :
(A) stator copper loss
(B) stator iron loss
(C) windage and friction losses
(D) all of the above

94. Lightning arrester should be located :
(A) away from the circuit breaker
(B) near the circuit breaker
(C) away from the transformer
(D) near the transformer

95. Corona loss is maximum in:
(A) ACSR
(B) stranded wire
(C) unstranded wire
(D) transposed wire

96. For a load flow solution the quantities normally specified at a voltage controlled bus are :
(A) P and Q
(B) P and |V|
(C) Q and |V|
(D) P and δ

97. Mho relay is normally used for protection of :
(A) Long transmission lines
(B) Medium length lines
(C) Short length lines
(D) None of these

98. The voltages at the two ends of a line are 132 KV and its reactance is 40 ohms. The capacity of the line is :
(A) 435.6 MW
(B) 217.5 MW
(C) 251.5 MW
(D) 500 MW

99. For stability and economic reasons we operate the transmission line with power angle in the range :
(A) 10° to 25°
(B) 30° to 45°
(C) 60° to 75°
(D) 65° to 80°

100. Ferranti effect on long overhead lines is experienced when it is :

(A) On full load at unity pf
(B) Lightly loaded
(C) On full load at 0.8 pf lag
(D) In all these cases

101. Load flow study is carried out for :

(A) Fault Calculations
(B) Stability Studies
(C) System Planning
(D) Load Frequency Control

102. A transformer rated for 500 KVA, 11 KV/0.4 KV has an impedance of 10% and is connected to an infinite bus. The fault level of the transformer is :

(A) 500 KVA
(B) 5000 KVA
(C) $500\sqrt{3}$ KVA
(D) None of these

103. In a pure LC parallel circuit under resonance condition, current drawn from the supply mains is :

(A) Very large
(B) $V\sqrt{LC}$
(C) $V/\sqrt{LC}$
(D) Zero

104. The insulation of modern EHV lines is designed based on :

(A) The lighting voltage
(B) Corona
(C) Radio Interference
(D) Switching Voltage

105. Severe over-voltages are produced during arcing faults in a power system with the neutral :

(A) isolated
(B) solidly earthed
(C) earthed through a low resistance
(D) none of these

106. The zero sequence impedance of different elements of power system is generally :

(A) equal
(B) zero
(C) different
(D) none of these

107. Resistance switching is used in :

(A) Bulk oil circuit breakers
(B) Minimum oil circuit breakers
(C) Air blast circuit breakers
(D) All types of breakers

108. Surge protector provides :

(A) high impedance to normal voltage
(B) low impedance to surge
(C) both (A) and (B)
(D) none of these

109. Thermal protection switch is able to protect against :

(A) overload
(B) over voltage
(C) temperature
(D) short circuit

110. Which type of plant has the minimum running cost per KWh of energy generated ?
(A) Hydro-Electric Plant
(B) Thermal Power Plant
(C) Nuclear Power Plant
(D) Diesel Power Plant

111. In resonant pulse inverters :
(A) dc output voltage variation is wide
(B) the frequency is low
(C) the output voltage is never sinusoidal
(D) dc saturation of transformer care is minimised

112. The effect of d.c. saturation in a rectifier transformer is :
(A) to decrease the output
(B) to increase the output
(C) to decrease the a.c. components of the output
(D) none of the above

113. In a 3-ϕ half-wave rectifier, each diode conducts for a duration of :
(A) 180°
(B) 30°
(C) 60°
(D) 45°

114. A converter which can operate in both 3-pulse and 6-pulse modes is a :
(A) 1-ϕ full converter
(B) 3-ϕ half wave convertor
(C) 3-ϕ semi converter
(D) 3-ϕ full converter

115. A 1-ϕ full bridge inverter can operate in load-commutation mode in case load consists of :
(A) RLC overdamped
(B) RLC underdamped
(C) RLC critically damped
(D) None of these

116. In circulating-current type of dual converter, the nature of voltage across reactor is :
(A) alternating
(B) pulsating
(C) direct
(D) triangular

117. In a 3-ϕ full converter, the output voltage pulsates at a frequency equal to :
(A) Supply frequency, f
(B) 2f
(C) 3f
(D) 6f

118. In a single pulse modulation of PWM inverters, the pulse width is 120°. For an input voltage of 220V dc, the rms value of output voltage is :
(A) 179.63 V
(B) 254.04 V
(C) 127.02 V
(D) None of these

119. In a dual converter, converters 1 and 2 work as under :

(A) 1 as rectifier, 2 as inverter
(B) both as rectifiers
(C) both as inverter
(D) none of these

120. In a constant source inverter, if frequency of output voltage is f Hz. Then frequency of voltage input to constant source inverter is :

(A) f
(B) 2f
(C) 3f
(D) 4f

ROUGH WORK

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